CANOBA (CARBON AND NUTRIENT CYCLING IN THE NORTH SEA AND THE BALTIC SEA)*

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During the last two years an international carbon cycle program has been established for the North Sea with participants from the Netherlands, Belgium and Germany and major funding by the Dutch Organisation for Scientific Research (NWO). The aim of the study has been to assess simultaneously all relevant parameters of the carbon and nutrient cycle during all four seasons covering a dense 97 stations grid across the entire North Sea. The cruises were carried out in August/September 2001 (summer), November 2001 (autumn), February/March 2002 (winter) and May 2002 (spring).

First results of the partial pressure difference between the atmosphere and the sea surface (ΔpCO_2) indicate the North Sea as an overall sink for atmospheric CO_2 (Fig. 16). During the summer, a clear distinction between the shallower, well-mixed southern part of the North Sea and the deeper, stratified northern part is evident from the ΔpCO_2 distribution. In the northern part the surface waters are undersaturated with respect to CO_2 as a consequence of biological CO_2 drawdown and export of organic matter to the deeper layers. In contrast, the southern part does not allow the escape of organic matter to any deeper layer. The remineralisation thus occurs in the euphotic zone and counteracts the CO_2 drawdown. As a result no net CO_2 draw-

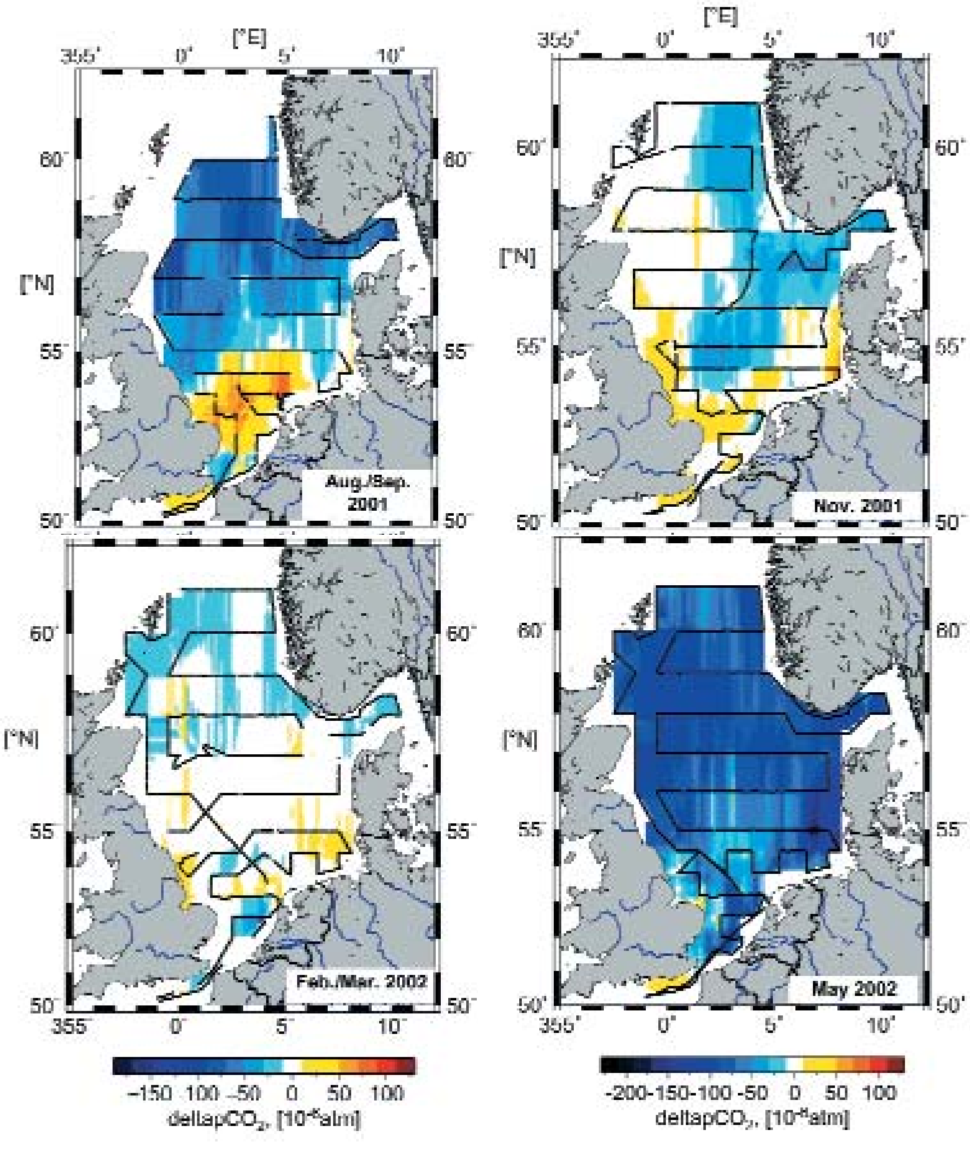

Fig. 16: ΔpCO_2 distribution observed in the North Sea during all four seasons: a) summer, b) autumn, c) winter and d) spring.

down is possible and the warming of the surface waters during summer increase the pCO_2. During autumn and winter the surface system heads toward equilibration and only slight super- or undersaturation is visible in February. During spring, which is the time of highest primary productivity the entire North Sea is strongly undersaturated because of the strong CO_2 uptake by biological activity (Fig. 16).

The $NO_{3/2}$ and DIC profiles (Fig. 17) from a central station of the North Sea clearly indicate the seasonal cycle. The wintry mixed layer shows the higher and homogeneous concentrations of DIC. The onset of the spring bloom then starts to decrease the DIC in the surface waters. The export of organic matter to the deeper layers with subsequent remineralisation increases the DIC. Lowest DIC concentrations in the surface waters and highest DIC concentrations in the subsurface waters are observed during summer, when both processes, surface layer production and subsurface remineralisation show the highest extent. During autumn the water column is homogenised by the deepening of the mixed layer until the winter situation is reached again. From the first view, the sum of nitrate and nitrite ($NO_{3/2}$) shows a similar behaviour. However, $NO_{3/2}$ is depleted in the surface layer during spring and summer and does not show any enrichment in the subsurface layer. These observations point to a strong decoupling of carbon and nitrogen cycles. The data evaluation will employ both field observations and ecosystem modelling results. The modelling is partially funded through the Dutch LOICZ.

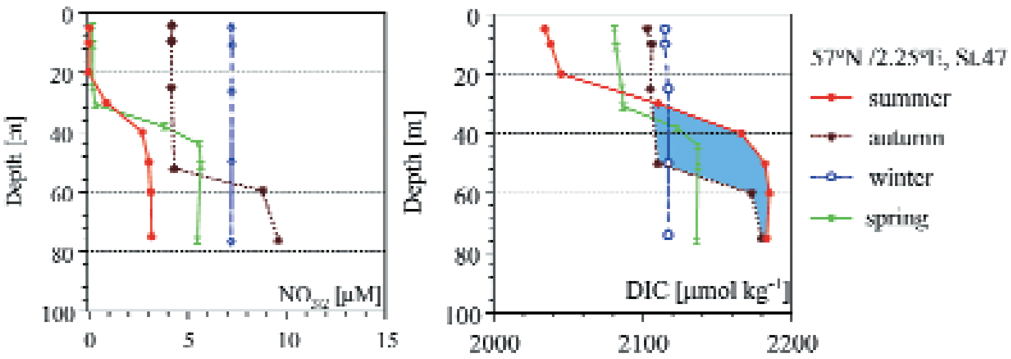

Fig. 17: Seasonal profiles of the sum of Nitrate and nitrite ($NO_{3/2}$) and DIC observed at a station in the central North Sea. The blue shaded area indicates the enrichment of DIC in the subsurface waters relative to the winter level.

**CANOBA was intended to be an European initiative investigating carbon and nutrient cycles of the North Sea and the Baltic Sea jointly. The present CANOBA currently realises this aim for the North Sea as an international effort and the corresponding counterpart for the Baltic Sea is being set-up just now.*